Fermilab

CDF CRYOGENIC SYSTEM WET ENGINE SWAP
JHA/WORK PERMIT

Job Name: Cryogenic System Wet Engine Swap

Location: CDF Assembly Hall Main Floor Cryo Area

Job Duration: Four Hours* **Date Work is Performed:**

Work to be performed by: CDF Cryo Systems Personnel

Supervisor: Bill Noe or Jim Loskot

Phone Extensions: x 4553 (Noe), x 3356 (Loskot), x 3632 (Cryo Control Room)

DESCRIPTION OF WORK:

For instances when the on-line wet engine performance has degraded such that the cryo plant cannot provide the required refrigeration, a spare wet engine that has already been rebuilt is put on-line replacing the defective engine. In order to complete this work, the procedure below is completed while adhering to the hazard mitigation requirements. A minimum of three people are required for this work.

ASSOCIATED HAZARDS:

(1) While pulling the wet engine U-tubes, extremely cold helium vapor and possibly liquid are released. U-tubes surfaces will remain very cold for some period of time after they are pulled. Exposure of the cold fluids or surfaces to one's flesh can cause serious burns.

(2) Pressurized helium gas at 10 psig or less per procedure. Gas or particulate in gas could possibly harm exposed skin.

(3) The wet engine is connected to 120V/60Hz power during normal operations. Unexpected contact with this power could result in personnel injury.

(4) Hazards associated with using a crane. The wet engine weight is estimated at 2200 pounds.

*Four Hour time estimate includes powering down the solenoid, performing the procedure, recovering the plant, and powering up the solenoid assuming that the work begins with the magnet control dewar full, the storage dewar at minimum 45% full and no unexpected problems. Beginning this procedure with unsatisfactory plant conditions will add significantly to the recovery period.

HAZARD MITIGATION:

(1) Proper personal protective equipment must be worn. This includes a face shield and cryo gloves. In addition, open toe shoes and shorts are not to worn.

(2) High pressure helium gas is isolated from the CDF building per the procedure below. After this is done, the wet engine must be allowed to operate until the high pressure gas circuit is lowered to a pressure of 10 psig or less. Wear PPE as specified above.

(3) The procedure requires that the power and controls wiring be disconnected in order to perform the engine swap. The wet engine is isolated from line power after this step.

(4) The vicinity around the wet engine and cryo area is to be cordoned off to prevent unauthorized personnel from entering this area.

(5) Personnel using the crane are required to have Fermilab Crane Training.

WORK PROCEDURE:

___1. Power down the Solenoid.

___2. Acquire the required PPE; cryo gloves, face shields.

___3. Obtain the tools necessary for the work; 12" pipe wrench, crane and controller, crescent wrench, and four spare caster wheels.

___4. Isolate the high pressure helium gas supply from the CDF building by hitting the high pressure helium supply Crash Button. LOTO Tag this crash button for the duration of this work procedure.

___5. Allow the high pressure helium gas circuit to depressurize to 10 psig or less as read by the Intake Gage on the engine or the high pressure HX pressure on i-Fix. Keep the dry engine running.

___6. Hit the Crash Button on the wet engine.

___7. Position two people in order to pull the U-tubes. The third person involved is to observe.

___8. After the U-tubes are pulled, immediately begin a warm helium gas purge to each U-tube in order to warm them.

___9. Reset the high pressure helium supply Crash Button and setup the plant with the JT loop in Auto.

___10. Disconnect the control, power, and instrumentation cables from the engine. Secure cables.

___11. Remove the guard cover.

___12. Unbolt the engine from the floor.

___13. Use crane to lift wet engine about eight inches from the floor and install the four casters.

___14. Lower the engine to the floor and roll out of the immediate area.

___15. Roll the replacement engine into position and raise with crane about eight inches.

___16. Remove casters and lower engine into position. Bolt to the floor.

___17. Attach power, control, and instrumentation cables.

___18. When U-tubes are warm and dry, prepare to install them.

a. Isolate the high pressure helium gas supply from the CDF building by hitting the high pressure helium supply Crash Button.
b. Maintain helium purge through the U-tubes.
c. After the high pressure helium gas circuit is depressurized to below 10 psig, install the U-tubes with two people while the third person is observing.

___19. Check vacuum levels on Engine (< 15 microns) and U-tubes (<10 microns). Pump as required.

___20. Reset the high pressure helium supply Crash Button and remove the LOTO tag. Reset wet engine controller and start engine. Run it at its minimum speed until cold (~45K). Then gradually increase the speed. At 350 rpm, take the plant out of JT mode. The engine is ready to switch to Auto when the engine inlet temperature is approximately 20K and the outlet is 10K.

___21. When plant is recovered, contact the second floor control room and begin powering the solenoid.

Prepared by: J. Loskot, B. Noe, D. Allspach **Date:** 9-26-06

Approved by: _____ **Date:** _____
CDF Operations Head

SIGNATURE LIST OF WORKERS INVOLVED IN THIS TASK

My supervisor has reviewed this Work Plan & Hazard Analysis with me and I understand the hazards and required precautionary actions. I will follow the requirements of this plan or notify my supervisor if I am unable to do so.

Name (print)	ID #	Signature	Date